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Technical Reference—

Operating and Troubleshooting the TxE Model Washer-extractors

Read the Safety Manual

PELLERIN MILNOR CORPORATION POST OFFICE BOX 400, KENNER, LOUISIANA 70063 - 0400, U.S.A.

Applicable Milnor® products by model number:

30015T5E 30022T5E

Preface

i. About This Manual

Document BICEUK01
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i. 1. Scope

This manual provides commissioning, operating, and troubleshooting instructions for Milnor® washer-extractors in the TxE model line, which are equipped with the Milnor® electronic timer control. See the installation manual for information on machine installation procedures and mechanical requirements. See the service manual for preventive maintenance, service procedures, and mechanical parts identification. See the schematic manual for electrical parts identification and electrical troubleshooting instructions.

i. 2. How To Identify This Manual and Its Included Documents [Document BIUUUD13]

A complete identification of this manual or any document in this manual must include **all** specifications shown on the front cover, as defined below:

Published manual number—Primary identification number for the manual or any variation of it.

Specified date—The approximate date of introduction of the product or product change this manual covers.

As-of date—When a manual for an old product is generated, any new information about the old product developed up to this date will be included in the manual.

Access date—The date the manual was generated (assembled and formatted).

Applicability—Code(s) that represent a group of machines this manual applies to and/or actual model numbers of applicable machines. The complete list of applicable models is provided inside the front cover.

When referring to any **document** used in this manual (as identified by an eight-character document number such as BIUUUD13 at the start of the document), a complete identification of the document must include all specifications shown on the front cover, except substituting the document number for the published manual number.

i. 3. Trademarks of Pellerin Milnor Corporation [Document BIUUUD14]

The following, some of which may be used in this publication, are trademarks of Pellerin Milnor Corporation:

Table1: Trademarks

Ampsaver®	Dye-Extractor®	Gear Guardian®	Milnet®	Staph-Guard®
Autolint®	Dyextractor®	Hands-Off®	Milnor®	System 4®
Auto-Purge®	E-P Express®	Hydro-Cushion®	Miltrac	System 7®
Autovac	E-P OneTouch®	Mentor™	Miltron	Totaltrol
CBW®	E-P Plus®	Mildata®		

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Chapter 1
Commissioning

1.1. Important Owner/User Information

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The following two procedures must be completed before this machine is placed in service:

1. Ensure the safety of all laundry personnel.
2. Customize the machine controller for the intended machine application.

1.1.1. Ensure Safety of All Laundry Personnel

Ensure that all personnel who will operate or maintain this machine read the safety manual before permitting them to access the machine. Ensure that all user manuals are available to the appropriate personnel and that all precautions explained in all applicable manuals are observed.

1.1.2. Customize the Machine Controller

Customizing the controller includes verifying that it is configured for the particular application (set of four pre-programmed formulas) for which the machine will be used. Always verify the machine configuration when the machine is first placed in service and after replacing the microprocessor controller.

Configure this machine for its intended purpose by setting DIP switch SW1 on the microprocessor controller. See the table of contents for this manual for the location of detailed configuration instructions.

— End of BICEUK02 —

1.2. About the Forces Transmitted by Milnor® Washer-extractors

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During washing and extracting, all washer-extractors transmit both static and dynamic (cyclic) forces to the floor, foundation, or any other supporting structure. During washing, the impact of the goods as they drop imparts forces which are quite difficult to quantify. Size for size, both rigid and flexibly-mounted machines transmit approximately the same forces during washing. During extracting, rigid machines transmit forces up to 30 times greater than equivalent flexibly-mounted models. The actual magnitude of these forces vary according to several factors:

- machine size,
- final extraction speed,
- amount, condition, and type of goods being processed,
- the liquor level and chemical conditions in the bath preceding extraction, and
- other miscellaneous factors.

Estimates of the maximum force normally encountered are available for each Milnor® model and size upon request. Floor or foundation sizes shown on any Milnor® document are only for on-grade situations based only on previous experience without implying any warranty, obligation, or responsibility on our part.

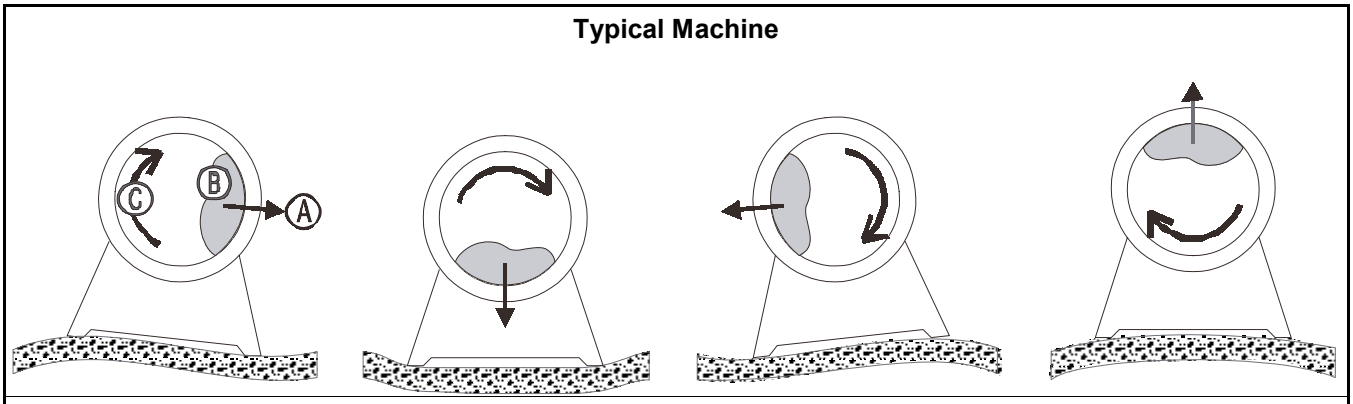
1.2.1. Foundation Considerations

Size for size, rigid washer-extractors naturally require a stronger, more rigid floor, foundation, or other supporting structure than flexibly-mounted models. If the supporting soil under the slab is itself strong and rigid enough and has not subsided to leave the floor slab suspended without support, on grade installations can often be made directly to an existing floor slab if it has enough strength and rigidity to safely withstand our published forces without transmitting undue vibration. If the subsoil has subsided, or if the floor slab itself has insufficient strength and rigidity, a deeper foundation, poured as to become monolithic with the floor slab, may be required. Support pilings may even be required if the subsoil itself is "springy" (i.e., if its resonant frequency is near the operating speed of the machine). Above-grade installations of rigid machines also require a sufficiently strong and rigid floor or other supporting structure as described below.

1.2.2. How Strong and Rigid?

Many building codes in the U.S.A. specify that laundry floors must have a minimum live load capacity of 150 pounds per square foot (732 kilograms per square meter). However, even compliance with this or any other standard does not necessarily guarantee sufficient rigidity. In any event, it is the sole responsibility of the owner/user to assure that the floor and/or any other supporting structure exceeds not only all applicable building codes, but also that the floor and/or any other supporting structure for each washer-extractor or group of washer-extractors actually has sufficient strength and rigidity, plus a reasonable factor of safety for both, to support the weight of all the fully loaded machine(s) including the weight of the water and goods, and including the published 360º rotating sinusoidal RMS forces that are transmitted by the machine(s). Moreover, the floor, foundation, or other supporting structure must have sufficient rigidity (i.e., a natural or resonant frequency many times greater than the machine speed with a reasonable factor of safety); otherwise, the mentioned 360º rotating sinusoidal RMS forces can be multiplied and magnified many times. It is especially important to consider all potential vibration problems that might occur due to all possible combinations of forcing frequencies (rotating speeds) of the machine(s) compared to the natural frequencies of the floor and/or any other supporting structure(s). A qualified soil and/or structural engineer must be engaged for this purpose.

Figure 1: How Rotating Forces Act on the Foundation



Legend

A. Direction of force
B. Load
C. Rotation (Frequency = RPM / 60)

Figure 1 above is intended to depict both on-grade and above-grade installations and is equally applicable to flexibly-mounted washer-extractors, as well as to rigid models installed either directly on a floor slab or on a foundation poured integrally with the slab. Current machine data is available from Milnor® upon request. All data is subject to change without notice and may have changed since last printed. It is the sole responsibility of every potential owner to obtain written confirmation that any data furnished by Milnor® applies for the model(s) and serial number(s) of the specific machines.

— End of BIWUUI02 —

1.3. Important Instructions for Pumped Chemical Inlets

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1.3.1. How Pumped Chemical Systems Can Internally Damage the Washer-extractor

Many pumped liquid chemical systems dribble concentrated chemicals out of the injection tubes when the system is not used for relatively long periods of time—as after working hours and during weekends. This puts highly concentrated corrosive chemicals in direct contact with dry stainless steel surfaces, and often directly on any textiles left in the machine. **Chemical deterioration (rusting) of the stainless steel and damage to the textiles is the inevitable result.**

Pellerin Milnor Corporation accepts absolutely no responsibility whatsoever for damage to its equipment or to any textiles therein when concentrated chemicals dribble out of the injection tubes onto any part of the machine or its contents.

Supplemental Topic 1

Preventing Dribbling by Purging Chemical Lines

Although the injection site is flushed by washer agitation on some models and after each injection on other models to aid the injection process, this flushing provides absolutely no protection against harmful dribble which occurs later—when the machine is no longer in use.

One foolproof solution for "dribbling" is to completely purge the appropriate chemical injection tube with fresh water after every injection, so that only fresh water (which cannot cause a problem) can dribble out.

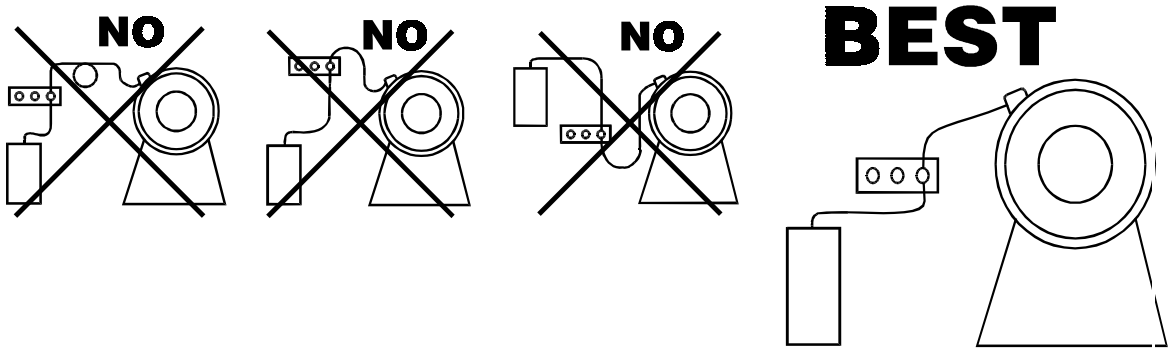
Obviously, it is the sole responsibility of the pump and/or chemical supplier (not the machine manufacturer) to furnish such a flushing device. (We understand that such flushing type chemical injection systems—both for retrofit to existing systems and for new installations—are now offered by others.)

1.3.2. Locating Chemical System Components to Reduce the Risk of Internal Damage

If the tubes, pumps, and chemical tanks are kept well below the injection point, the likelihood of "after-hours dribbling" is reduced, but not totally eliminated.

We therefore urge that tubes from any non-flushing pumped chemical system be connected as shown in Figure 2. Although fresh-water flushing the just-used tubes after each injection would be better, we believe routing the tubes as indicated will probably minimize the dribbling effect about as much as possible without flushing. Never permit tanks, pumps, or any portion of the tubes to be higher than the injection point. If loops in the injection tubes are employed, make sure the entire loop is well below the injection point.

Figure 2: Proper Routing of Chemical Tubing



Note 1: As shown in Figure 2, all tanks, pumps, and tubing must be lower than the injection point on the machine and must not dribble chemicals into the machine, nor leak chemicals externally onto any portion of the machine or its surroundings.

1.3.3. Preventing Leaks Which Can Injure Personnel and Cause External Damage

All ports on the inlet are plugged at the Milnor® factory. When replacing plugs with fittings or when reinstalling plugs, always use the sealant furnished (LocTite RTV Silicone Adhesive or equivalent). Use properly sized hose barbs, always use clamps, and check for leaks. Use the hose barbs furnished with your machine only if they provide the proper fit for the tubes employed. Ensure that excessive pressures cannot build up that might burst or disconnect tubing. Instruct the operator to monitor for leaks and report any occurences.

When calibrating injections, it is permissible to remove tubes from barbed fittings to take samples. However, always check for leaks after installing tubes and clamps. A preferable method is to install a three-way or two two-way valves onto each injection tube for sampling.

Warning 1: Avoid chemical burns and corrosion—Concentrated liquid chemicals leaking from a chemical system can burn skin and eyes, cause other types of injury or illness, and corrode machine components.

- Ensure that excessive pressures cannot build up which might burst or disconnect a chemical delivery tube.
- Ensure that there are no external chemical leaks when the system is installed or calibrated.
- Periodically check the system for leaks during operation.

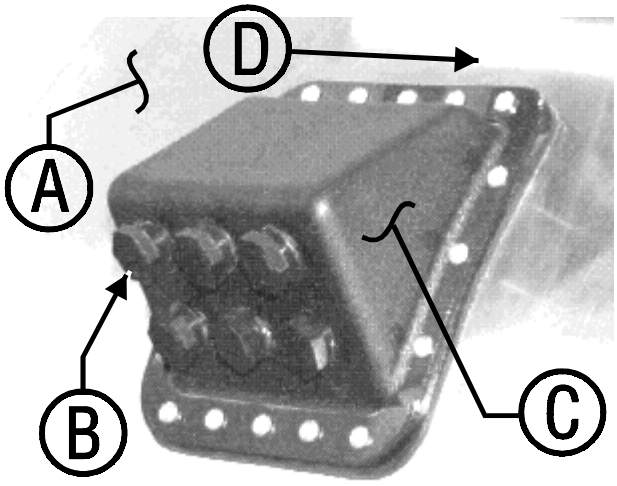
Caution 2: Avoid corrosion and textile damage—Chemicals dribbling into the machine when it is idle will corrode machine components and damage any textiles left in the machine.

- If possible, use a system that flushes the entire chemical delivery tube after each injection.
- If a non-flushing system is used, install tanks, pumps, and tubing below the injection point on the machine, such that chemicals travel to the machine at an upward angle.

Caution 3: Avoid explosions—Certain chemicals will react when combined.

- Connect chemical tubing so that bleach and sour inlets are as far apart as possible.

Figure 3: Liquid Supply Injection Port

Figure	Legend
	**A.** Machine shell **B.** Removeable plug **C.** Chemical injection housing **D.** Toward front of machine

Notice 4: Pellerin Milnor Corporation accepts absolutely no responsibility for damage to its equipment or to any textiles therein when concentrated chemicals dribble out of the injection tubes onto any part of the machine or its contents.

— End of BIWUUI01 —

1.4. Electrical Connections for Liquid Chemical Systems

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Warning 5: Electric Shock Hazard—Contact with high voltage electricity will kill or seriously injure you. Even when the machine is not running, three-phase power and control circuit power are still present at several locations within the cabinet and at some electrical components.

Caution 6: Injury and Damage Hazards—Improper wiring can cause the machine to malfunction, risking injury to personnel, damage to machine components, and damage to goods.

- Electrical and piping connections described in this section must be made only by qualified, authorized personnel.
- Lock off and tag out power at the external disconnect switches for the washer-extractor before proceeding.
- Do not rely merely on the information in this section when wiring. Consult all applicable electrical schematics.
- Do not reroute or rearrange any wires not specifically permitted by this instruction.
- Do not connect a common wire to ground. Use the common terminal furnished.

Caution 7: Risk of Poor or Inconsistent Wash Quality—Injection times of less than 10 seconds are discouraged because fine adjustments are not possible, and factors such as pump lag time may cause significant variations in the amount of chemical delivered.

- Size pumps or valves small enough for adequate control (i.e., for longer injection times).
- Use two pumps or valves to inject a small or large quantity of the same chemical, if required.

Supplemental Topic 2

Maximizing Chemical Injection Precision

Injection of a consistent amount of chemical is important in controlling wash quality and using chemicals economically. When chemicals are injected by units of time, as is done with most washer-extractors, injections of short duration can be imprecise because of two reasons:

- Fine adjustments to the delivered quantity are not possible. For example, if an injection of three seconds is extended by one second, the quantity delivered is theoretically increased by more than 30 percent. However, if an injection of 20 seconds is increased by one second, the theoretical quantity is increased by only five percent.
- Variations in the time between the start of the chemical signal and the start of the chemical delivery into the machine can cause significant differences in the quantity of chemical injected. In this case, if a pump starts more slowly some times than others, or if the delivery tubes are partially empty at the start of the inject period, the quantity of chemical delivered may vary significantly. As an example, assume a peristaltic pump moves chemical along the delivery tube at a rate of three feet per second. If the delivery tube is empty for three feet along its length, then one second of the injection time is spent injecting air rather than chemical. If the programmed injection time is only three seconds, then one third of the desired chemical is not being delivered. However, if the programmed injection time is 20 seconds, the chemical delivery is only five percent less than desired.

Increasing the programmed injection time makes any variation less significant. Use pumps and/or valves sized to allow inject times of at least 10 seconds. If injection times for a specific chemical vary widely from one formula to another, consider using two pumps or valves for the same chemical. Actuate one pump for injecting small quantities, and use both pumps or valves for larger quantities.

1.4.1. Pump Signal Connections

The microprocessor controller used on TxE models closes certain relay contacts when chemicals are desired and to flush the chemical system after each injection. These signals are 240 volts AC, and cannot be made potential-free. Any device driven by this signal can draw up to 37 milliamperes.

Note 2: The manifold flush signal is effective only if the chemical supply system (provided by others) is properly designed and connected to a flushing water source.

Caution 8: Component Damage Hazard—Board components will burn out and require board replacement if devices driven by inject signals do not meet the above electrical specifications. Pumps generally draw a higher current than specified, and will cause board damage.

This machine provides signals for three chemicals and a manifold flush. Table 2 contains the connection details for these signals. All chemical signal connections are available in on terminal strip TBS, as shown in Figure 4. This terminal strip is located in the electrical enclosure on the left rear of the machine, where the machine power connections are made.

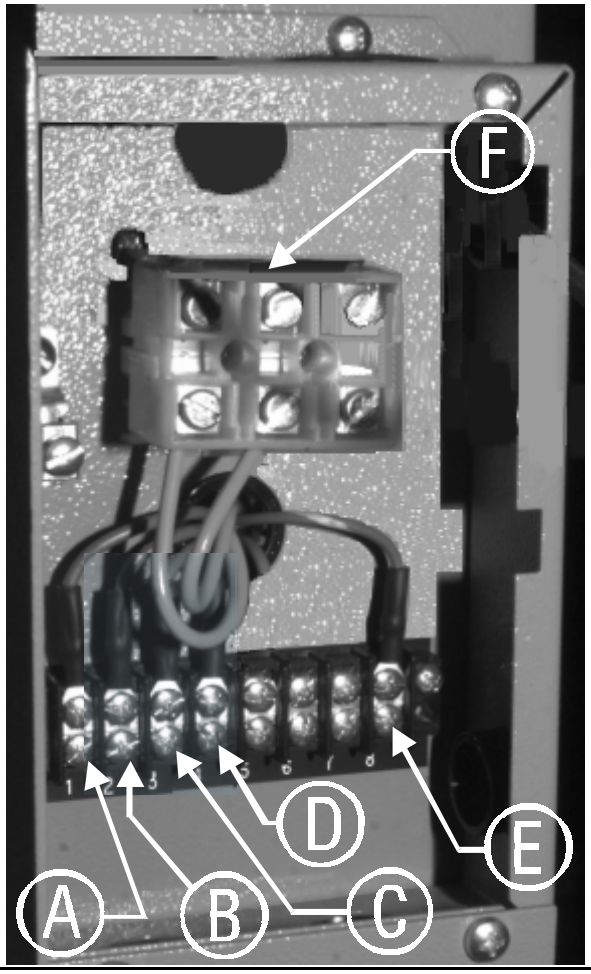
Note 3: Unless the "Timer Stop" feature is employed, each chemical signal is enabled for 30 seconds, starting 15 seconds after the desired level (usually low level) is achieved for the bath.

Table2: Chemical Injection Signals for TxE Models

Signal Component	Chemical	Relay	Processor Board Connection	TBS Terminal Number
Chemical 1	Detergent	K13	MTA6-7,8	1
Chemical 2	Bleach	K14	MTA6-3,4	2
Chemical 3	Finishing chemicals	K15	MTA6-1,2	3
Manifold Flush	none	K12	MTA7-1,2	4

Figure 4: Pump Signal Connections

Electrical Connections Enclosure



Legend

- **A.** Detergent signal
- **B.** Bleach signal
- **C.** Sour and starch/softener signal
- **D.** Manifold flush signal
- **E.** Chemical signal common
- **F.** Machine power connections

1.4.2. *Timer Stop* Connections

"Timer stop" is a feature of the TxE control which stops the machine timer while a certain input to the microprocessor is grounded. When multiple machines without this feature are connected to a common chemical supply system, the quantity of chemical injected can vary widely if two or more machines request chemical simultaneously. When properly wired, the chemical supply system stops the timers in certain linked machines when one machine requests

chemical. When the chemical injection is completed, the chemical supply system terminates the *timer stop* command, and the stopped timers resume counting.

When the timer in a machine is stopped, the current formula event continues until the timer resumes counting. If water valves are open when the timer stops, they will close when the desired level is reached. Chemical injection signals will stop after the designated time, but the manifold flush signal will not occur until the timer starts. All other actions (cylinder reversing, extract speed, drain speed, etc.) that are in progress when the timer is stopped will continue until the timer starts again and the programmed time for the current event expires.

Milnor provides two wires terminated with butt connectors in the rear console of the machine. One wire originates electrically from pin 4 of MTA7 on the processor board. The other wire is electrically identical to pin 6 of MTS1 on the switch panel board. For *timer stop* to function, the chemical system should include a normally open contact between these two connectors. When the contact is open, the machine runs normally. When the contact is closed, the machine timer stops.

— End of BICEUI01 —

1.5. Formulas in Milnor® TxE Electronic Timer Washer-extractors

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This section describes the formulas provided in your washer-extractor with the Milnor® electronic timer controller. For each configuration, the table shows each step in the four available formulas.

Two software chips are available for these machines: hotel and hospitality, and healthcare. Your machine was shipped from the Milnor factory with the chip set specified when the machine was ordered. Contact the factory to purchase the chip necessary to change the machine from one industry to another.

Note 4: Because plant water pressure influences the time required for the machine to fill, the run times stated in the tables below do not include machine fill times.

Note 5: Drain and coast times are subject to change without notice.

Note 6: Certain chemical supply systems may actuate an input to the microprocessor which stops the formula timer. This action increases the total time required for the formula to complete, but does not affect the elapsed time.

1.5.1. Hotel and Hospitality Configuration

Table3: Hotel and Hospitality Formula Set 1

Operation	Formula A: Blankets and Spreads				Formula B: Sheets				Formula C: Towels				Formula D: White Heavy Soil			
	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level
Flush													2		S	Hi
Drain													1.25			
Bath	8	D	S	Lo	10	DB	H	Lo	7	D	H	Lo	10	D	H	Lo
Drain	1.25				1.25				1.25				1.25			
Rinse	2		S	Hi	2		H	Hi								
Drain	1.25				1.25											
Bath									7	B	H	Lo	7	B	H	Lo
Drain									1.25				1.25			
Rinse	2		C	Hi					2		H	Hi	2		H	Hi
Drain	1.25								1.25				1.25			
Extract					1				1				1			
Coast					1.25				1.25				1.25			
Rinse					2				2		S	Hi	2		S	Hi
Drain					1.25				1.25				1.25			
Extract					1				1				1			
Coast					1.25				1.25				1.25			
Bath	4	F	C	Lo	4	F	C	Lo	4	F	C	Lo	4	F	C	Lo
Note: A DIP switch setting allows configuring this operation for split fill.																
Drain	1.25				1.25				1.25				1.25			
Extract	7				6				7				7			
Coast	1.25				1.25				1.25				1.25			
Run Time	29.25				34.75				41.0				47.25			

Key to Abbreviations:

D	Usually detergent	H	Hot water	Hi	High level
B	Usually bleach	C	Cold water	Lo	Low level
F	Sour/softener or sour/starch	S	Split water		

Notes:

1 For any bath step, the timer does not run until the desired level is achieved.

Table4: Hotel and Hospitality Formula Set 2

Operation	Formula A: Colored 100% Poly Table Linen				Formula B: White 100% Poly Table Linen				Formula C: Stain Treatment				Formula D: White Kitchen Goods			
	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level
Bath	10	D	H	Lo	10	D	H	Lo	20	DB	H	Lo	5	D	H	Lo
Carryover													1		H	Hi
Drain	1.25				1.25				1.25				1.25			
Rinse									2		H	Hi				
Drain									1.25							
Bath					7	B	H	Lo					8	D	H	Lo
Drain					1.25								1.25			
Rinse	2		S	Hi	2		S	Hi	2		H	Hi	2		H	Hi
Drain	1.25				1.25				1.25				1.25			
Bath													7	B	H	Lo
Drain													1.25			
Rinse	2		S	Hi	2		S	Hi	2		S	Hi	2		S	Hi
Drain	1.25				1.25				1.25				1.25			
Extract									1				1			
Coast									1.25				1.25			
Rinse									2		S	Hi	2		S	Hi
Drain													1.25			
Bath	4	F	C	Lo	4	F	C	Lo					4	F	C	Lo
Note: A DIP switch setting allows configuring this operation for split fill.																
Drain	1.25				1.25				1.25				1.25			
Extract	2.5				2.5				7				7			
Coast	1.25				1.25				1.25				1.25			
Run Time	30.0				35.0				44.75				50.25			

Key to Abbreviations:

D	Usually detergent	H	Hot water	Hi	High level
B	Usually bleach	C	Cold water	Lo	Low level
F	Sour/softener or sour/starch	S	Split water		

Notes:

1 For any bath step, the timer does not run until the desired level is achieved.

1.5.2. Healthcare Configuration

Table5: Healthcare Formula Set 1

Operation	Formula A: Blankets and Spreads				Formula B: Sheets				Formula C: Towels				Formula D: Diapers and Pads			
	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level
Flush					2		S	Hi	2		S	Hi	3		S	Hi
Drain					1.25				1.25				1.25			
Bath	8	D	S	Lo												
Flush					2		S	Hi	2		S	Hi	2		S	Hi
Drain	1.25				1.25				1.25				1.25			
Flush													2		S	Hi
Rinse	2		S	Hi												
Drain	1.25												1.25			
Bath					7	D	H	Lo	7	D	H	Lo	7	D	H	Lo
Drain					1.25								1.25			
Carryover									1		H	Hi				
Rinse	2		C	Hi									2		H	Hi
Drain	1.25								1.25				1.25			
Bath					7	B	H	Lo	7	B	H	Lo	7	B	H	Lo
Drain					1.25				1.25				1.25			
Rinse					2		S	Hi	2		S	Hi	2		S	Hi
Drain					1.25				1.25				1.25			
Rinse					2		S	Hi	2		S	Hi	2		S	Hi
Drain					1.25				1.25				1.25			
Bath	4	F	C	Lo	4	F	C	Lo	4	F	C	Lo	4	F	C	Lo
Note: A DIP switch setting allows configuring this operation for split fill.																
Drain	1.25				1.25				1.25				1.25			
Extract	7				6				7				7			
Coast	1.25				1.25				1.25				1.25			
Run Time	29.25				34.75				44.00				50.50			

Key to Abbreviations:

D	Usually detergent	H	Hot water	Hi	High level
B	Usually bleach	C	Cold water	Lo	Low level
F	Sour/softener or sour/starch	S	Split water		

Notes:

1 For any bath step, the timer does not run until the desired level is achieved.

Table6: Healthcare Formula Set 2

Operation	Formula A: Personal Goods				Formula B: White 100% Poly Table Linen				Formula C: Stain Treatment				Formula D: White Heavy Soil			
	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level	Time	Chemicals	Temp	Level
Flush	2		S	Hi									2		S	Hi
Drain	1.25												1.25			
Bath	7	D	H	Lo	10	D	H	Lo	20	DB	H	Lo	10	D	H	Lo
Drain	1.25				1.25				1.25				1.25			
Rinse	2		H	Hi					2		H	Hi				
Drain	1.25								1.25							
Bath					7	B	H	Lo					7	B	H	Lo
Drain					1.25								1.25			
Rinse	2		S	Hi	2		S	Hi	2		H	Hi	2		H	Hi
Drain	1.25				1.25				1.25				1.25			
Extract													1			
Coast													1.25			
Rinse	2		S	Hi	2		S	Hi	2		S	Hi	2		S	Hi
Drain	1.25				1.25				1.25				1.25			
Extract									1				1			
Coast									1.25				1.25			
Bath	4	F	C	Lo	4	F	C	Lo	2		C	Hi	4	F	C	Lo
Note: A DIP switch setting allows configuring this operation for split fill.																
Drain	1.25				1.25				1.25				1.25			
Extract	6				2.5				7				7			
Coast	1.25				1.25				1.25				1.25			
Run Time	33.75				35.0				44.75				47.25			

Key to Abbreviations:

D	Usually detergent	H	Hot water	Hi	High level
B	Usually bleach	C	Cold water	Lo	Low level
F	Sour/softener or sour/starch	S	Split water		

Notes:

1 For any bath step, the timer does not run until the desired level is achieved.

— End of BICEUP01 —

Chapter 2
Configuring

2.1. Configuring TxE Washer-extractor Models

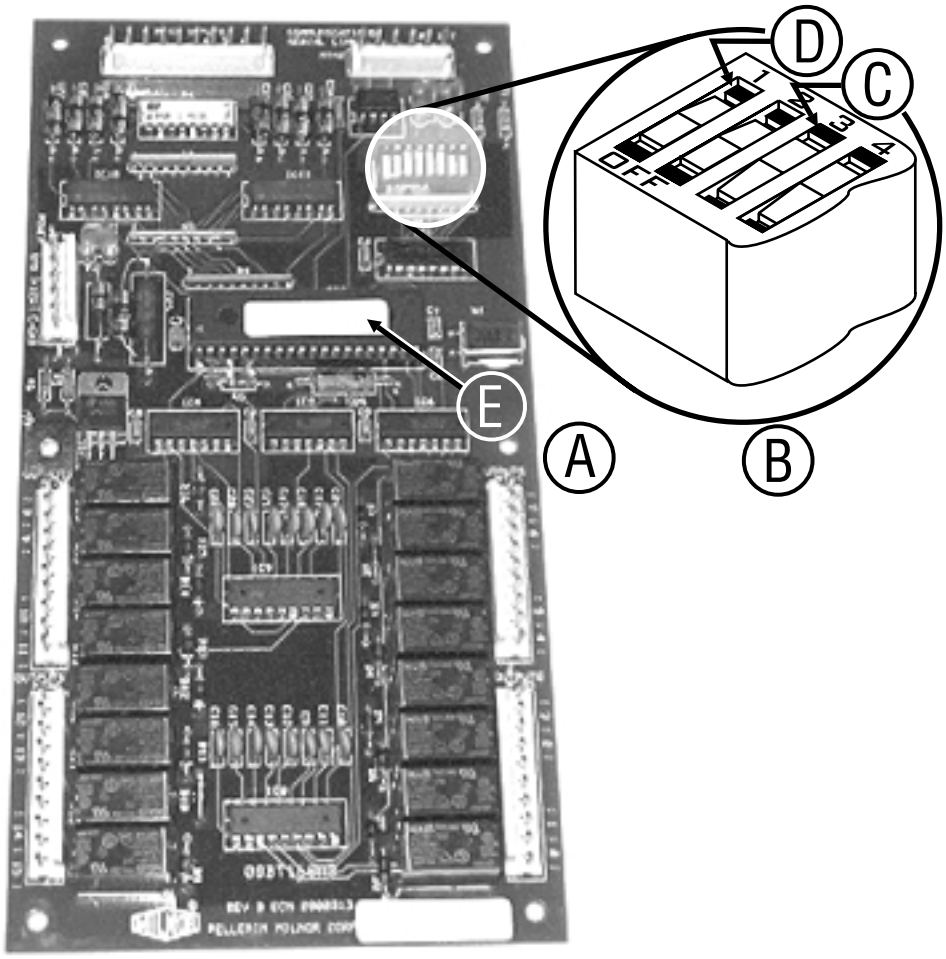
Document BICEUC01
Spec Date 20010122
As-of Date 20010122

Because the microprocessor that controls your machine during normal operation is also capable of other functions, it must be configured for your specific machine. Configuration information is controlled by a group of small switches (together called a DIP switch) on the processor board. When power is first applied to the machine, the microprocessor reads the *on* or *off* status of each of the DIP switch positions.

2.1.1. Is this switch position ON or OFF?

You can set each of the eight DIP switch positions to *on* or *off*. Turn any switch position *off* by pressing down on the side nearest the word "OFF." Turn the switch position *on* by pressing down on the side nearest the number. Use a pencil or a stiff wire to set the switch; it will click into position when pressed far enough. See Figure 5 for the DIP switch location.

Figure 5: Microprocessor board and DIP switch

Graphic	Legend
	**A.** Processor board **B.** Typical DIP switch (detail) **C.** Position 3 OFF (example) **D.** Position 1 ON (example) **E.** Software version label on EPROM

2.1.2. Configuration decisions

2.1.2.1. Selecting the Formula Set—DIP switch position 1 determines the formula set used. Set this switch position *on* (press the side nearest the number down) to configure the machine for the four primary formulas. Set this switch *off* (press the side nearest the word "OFF" down) to use the secondary set of formulas. The available formulas are listed in "Formulas in Milnor TxE Electronic Timer Washer-extractors" (see the table of contents).

2.1.2.2. Split water for final rinse—In some locations the temperature of the incoming cold water may be too cold to allow the proper activation of softener chemicals. In these locations, turn switch position 2 *off* (press the side nearest the word "OFF" down) to cause both water valves to open for all sour/softener steps.

2.1.2.3. Switch positions not used—Switch positions 3, 4, 5, 6, and 7 are not used. These positions have no effect on the operation of the machine.

2.1.2.4. Normal and diagnostic mode selection—Switch position 8 determines whether the machine is configured for normal operation or for diagnostics. With this position *on*, the machine operates normally by running formulas.

When switch position 8 is *off*, the machine is configured for diagnostics. When switch position 8 is *off*, connecting an optional display to the processor board aids in diagnosing problems by allowing a qualified technician to manually actuate outputs individually.

— End of BICEUC01 —

Chapter 3
Operating

3.1. Determining Load Size

Document BIWUUO01
Spec Date 20010122
As-of Date 20010122

Putting **too much** linen into a properly designed laundry washer-extractor will not **overload** the machine to its mechanical or electrical detriment if these guidelines are followed:

1. The goods consist of typical cotton and/or synthetic fabrics normally encountered in commercial laundering operations.
2. The load is not so bulky as to prevent a reasonably balanced distribution prior to the onset of extraction.
3. The extract speed has not been increased above the designed maximum.
4. The total number of intermediate and final extractions do not exceed the designed maximum for the extract motor.

Thus, the *maximum soiled linen capacity* for any properly designed washer-extractor is essentially limited by the amount of soiled goods that can actually be placed in the cylinder.

The maximum weight of soiled goods that a washer-extractor cylinder will accept depends on the following factors:

- the internal volume of the cylinder (the space into which the goods can be placed), and
- the density (weight and bulkiness) of the specific goods

For example, many polyester-cotton fabrics have relatively low weights for their bulk so one should rarely expect to be able to put in a published maximum capacity load of such fabrics. In fact, published maximum capacities of machines based on the now generally accepted industry standards will usually be achieved only with the highest density, closely woven fabrics and a reasonable soil content.

The best load size depends on the size of the machine—plus the type of goods, soil content, and wash quality desired. Since the latter factors vary considerably, prior experience and/or experimentation generally yield the best results. Use these guidelines:

1. Overloading a washer-extractor will not increase production because longer wash formulas and more rewash will be required.
2. Avoid underloads because the inevitable greater extraction imbalance will cause more extract re-cycles and may stress the machine unnecessarily.
3. Load divided cylinder machines so that the **weight in each compartment is approximately equal at the onset of extraction.** Do not put goods with grossly dissimilar water absorption characteristics in the different compartments. Do not attempt to balance loads of wet goods in one compartment against dry goods in the other.

— End of BIWUUO01 —

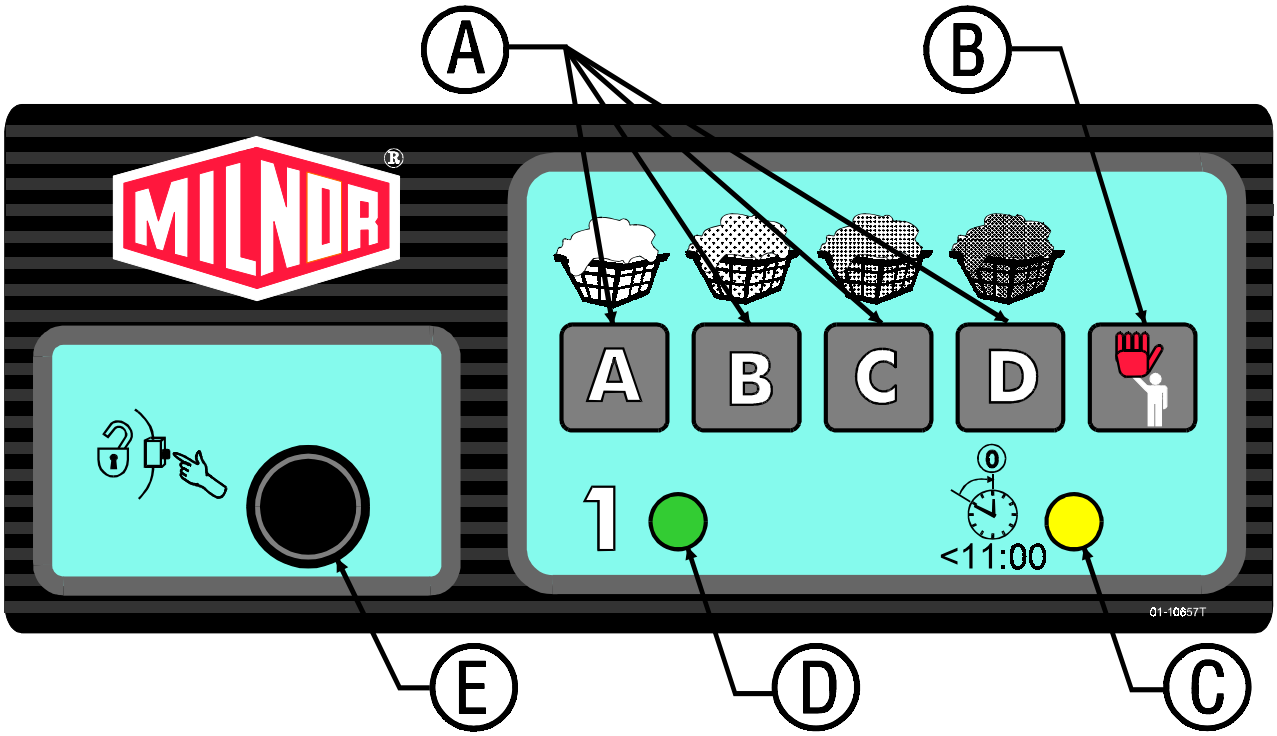
3.2. Controls on TxE Model Washer-extractors

Document BICEUF01
Spec Date 20010122
As-of Date 20010122

Most of the controls on Milnor® TxE washer-extractors are membrane push-buttons. Other controls include a mechanical push-button to unlock the door latch, and two lights to indicate that the machine is running and when the machine is nearing the end of a formula.

Figure 6: TxE Controls

Control Panel



Legend

A. Formula Selection buttons
B. Terminate button
C. Last Rinse light
D. In Progress light
E. Door Unlock button

3.2.1. Control Functions During Normal Operation

3.2.1.1. *Formula Selection* Buttons—The TxE controller provides four pre-programmed formulas that vary according to machine configuration. Start the desired formula by pressing the corresponding *Formula Selection* button (A, B, C, or D) with the machine loaded and the door closed.

Consult with your chemical supplier for the specific formula to use with each type of goods being processed.

3.2.1.2. *Terminate* Button—The *Terminate* button ( ) ends any running formula. When a formula is ended early, you must restart it from the beginning by pressing one of the the *Formula Selection* buttons with the door closed.

3.2.1.3. *Last Rinse* Light—This light comes on when the last bath step of any formula begins and remains on until the formula ends. If the operator needs to add a chemical during the last bath, such as softener, he should add it as soon as this light comes on. The *Last Rinse* light also alerts the operator that the machine will soon be ready for unloading.

If an error occurs during a formula, this light and the *In Progress* light flash (two seconds on, then two seconds off) for 10 minutes. After 10 minutes, both lights go off. The error can be a malfunction of either the door lock circuit or the inverter. In either case, all machine controls are locked out for 75 seconds to ensure that the cylinder has coasted to a stop. To open the door after an error occurs, press the *Terminate* button ( ) to clear the error condition, then hold the *Door Unlock* button ( ) and press firmly on the door latch handle.

3.2.1.4. *In Progress* Light—When power is first applied to the machine, this light flashes for 75 seconds to indicate that the power-up delay timer is counting down. The light goes off when the power-up delay expires.

This light is constantly *on* when a formula starts (the door is closed and a formula selection button is pressed). It remains on until the formula ends normally, is terminated by the operator, or an error occurs.

If the formula ends normally by running to completion, the *In Progress* light goes off when the last step of the formula ends. If the operator terminates a formula, this light flashes (two seconds on, then two seconds off) for 75 seconds as the coast timer counts down. After 75 seconds, hold the *Door Unlock* button ( ) and press firmly on the door latch handle to open the door.

3.2.1.5. *Door Unlock* Button—This button activates a solenoid in the door latch which unlocks the door latch handle, allowing the operator to open the door. To lessen the chance of injury caused by opening the door while the basket is turning, the microprocessor controller disables this button when a formula starts.

The *Door Unlock* button is disabled for 75 seconds after a formula ends, whether the formula ended normally, was ended early by the operator, or ended because of an error.

3.2.2. Control Functions During Testing

Do not attempt to test or troubleshoot a malfunctioning machine using only the information in this document. For complete testing procedures, see “Testing TxE Washer-extractors” (see table of contents).

The display kit referenced in Section 3.2.2.1 consists primarily of a vacuum fluorescent display and a wiring harness to temporarily connect the display to the processor board for testing by authorized, qualified technicians. This kit is available from Milnor.

3.2.2.1. *Formula Selection* Buttons

3.2.2.1.1. *Formula A* button (A)—With the display kit attached and the machine in normal operation mode (DIP switch position 8 is *on*), this button stops the formula timer as long as it is held depressed. The timer resumes running when the button is released. Hold this button to simulate the *timer stop* feature. *Timer stop* is used by some chemical injection systems to postpone chemical injection to a machine if the chemical system is already supplying chemical to another machine on the same chemical supply manifold.

Display or Action	Explanation
F:A EQ:003 CE:000 Level A1/D1 T-Run	Typical display in normal operation mode before button A is pressed.
F:A EQ:003 CE:000 Level A1/D1 T-Stop	Typical display in normal operation mode with button A held depressed.

If the machine is in testing mode (DIP switch position 8 is *off*), this button makes input A on the testing display and turns the next numerical output *on*. Holding A depressed causes the controller to turn each output *on* for about one half second, then *off* before advancing automatically and testing the next output in the sequence.

Note 7: For safety, the controller allows only one output to be turned on at a time in testing mode.

3.2.2.1.2. *Formula B* button (B)—This button is ignored if the machine is in normal operation mode and a formula is running. In testing mode, holding the *Formula B* button depressed makes input B to the microprocessor.

Display or Action	Explanation
ABCDEFGH Output # -+------ 00 is On	Typical display in testing mode with button B held depressed.

3.2.2.1.3. *Formula C* button (C)—With the display kit attached and the machine in normal operation mode (DIP switch position 8 is *on*), this button cycles the display through its three modes: timer display, inputs display, and outputs display. Each display is fully described in "Testing TxE Washer-extractors" in this manual. See the table of contents for the location of this document.

In testing mode (DIP switch position 8 is *on*), holding the *Formula C* button depressed makes input C to the microprocessor.

Display or Action	Explanation
ABCDEFGH Output # --+----- 00 is On	Typical display in testing mode with button C held depressed.

3.2.2.1.4. *Formula D* button (D)—This button is ignored if the machine is in normal operation mode and a formula is running. In testing mode (DIP switch position 8 is *off*), holding the *Formula D* button depressed makes input D to the microprocessor.

Display or Action	Explanation
ABCDEFGH Output # ---+---- 00 is On	Typical display in testing mode with button D held depressed.

3.2.2.2. *Terminate* Button—In normal operation mode, this button terminates the formula in progress. All controls are immediately locked out for a safety delay of 75 seconds.

In testing mode (DIP switch position 8 is *off*), the *Terminate* button provides input F to the microprocessor.

3.2.2.3. *Last Rinse* Light—In normal operation the *Last Rinse* light illuminates constantly from the beginning of the last bath step (last rinse) until the formula ends, 75 seconds after the end of the final extract step.

In testing mode (DIP switch position 8 is *off*), the *Last Rinse* light illuminates when output 8 is *on*.

3.2.2.4. *In Progress* Light—In normal operation with the display attached, this light is illuminated when output j is present.

Display or Action	Explanation
`abcdefghijklmnop` `--+--+---+------`	Typical display during normal operation with the drain closed (output c), the basket turning clockwise (output f), and the *In Progress* light illuminated (output j).

In testing mode (DIP switch position 8 is *off*), the *In Progress* light illuminates when output 9 is *on*.

3.2.2.5. *Door Unlock* Button—In normal operation with the display attached, this button is enabled 75 seconds after a formula ends for any reason. The door cannot be unlocked until the 75-second safety delay expires. The safety delay also applies for 75 seconds after power is first applied to the machine.

In testing mode (DIP switch position 8 is *off*), the *Door Unlock* button is energized only when output 00 is *on*. With output 00 *on*, you should hear the door unlock when this button is pressed.

— End of BICEUF01 —

3.3. E-timer Operation

Document BICEUO01
Spec Date 20010122
As-of Date 20010122

3.3.1. Instructions for Normal Operation

3.3.1.1. Load the Machine

1. If the loading door is closed and latched, hold the *Door Unlock* button (🔓) to unlock the door while pressing firmly on the door latch handle with the other hand. If the door does not unlock, verify that the machine is connected to power and that the wall disconnect is functioning properly. The machine must have power available to unlock the door.
2. When the door opens, load the machine according to plant guidelines and “Determining Load Size” (see table of contents).
3. Close the door firmly.

3.3.1.2. Start a Formula

3.3.1.2.1. After a Completed Formula (Normal)—If the previous formula finished normally, simply press the button that matches the formula you want to run. The selected formula will start immediately if the door is closed. The *Formula Running* light (1) illuminates and the door locks immediately, and the machine fills with water. Once the door is locked, the operator must end the formula early (see Section 3.3.2) or wait for the formula to finish before opening the door.

3.3.1.2.2. After Opening the Door during a Formula—If you ended the previous formula early by opening the door, you must press the *Terminate* button ( ) before you can start the machine again. The *Terminate* button also clears any internal machine error that might have caused the formula to end early.

3.3.1.3. Unload the Machine—When the formula ends, the *Formula Running* light (1) goes out. Hold the *Door Unlock* button ( ) to unlock the door and press firmly on the door latch handle.

3.3.2. How to End a Formula Early

You can end any running formula by pressing the *Terminate* button ( ) on the control panel. A safety delay keeps the door locked for 75 seconds. When the In Progress light goes off, hold the *Door Unlock* button ( ) to unlock the door and press firmly on the door latch handle.

To resume operation, restart the formula from the beginning by pressing the desired formula button.

— End of BICEUO01 —

Chapter 4
Testing and Troubleshooting

4.1. Troubleshooting Errors

Document BICEUT03
Spec Date 20010122
As-of Date 20010122

4.1.1. Vibration Switch Tripped

If the machine vibrates excessively during extract, the vibration switch (SMWVB in the electrical schematics) closes to ground an input (MTA3-10) to the microprocessor. When the machine is in an extract step and this input is grounded, the controller immediately ends the extract step and starts the following coast step. The formula then continues normally.

Note 8: The vibration switch is physically located in the machine console, below the power supply. See the document entitled "30015 and 30022T5E Component Location Details" in the schematic manual.

Note 9: The input which indicates that the vibration switch is tripped is shared with the high water level pressure switch. Software determines whether to turn off the water valve(s) or to signal the inverter to stop the motor depending on the step running when the input is grounded.

4.1.2. Door Open

When the machine door is closed and the machine is operating normally, contacts 5 and 8 in relay CRDL are closed, grounding the input on MTA3-7 to the microprocessor. If the door opens, the input is lost. When the microprocessor loses the input, it signals an error and stops the machine. For safety, all machine controls remain disabled for 75 seconds after the error occurs.

When this error occurs, the microprocessor signals the error by flashing both the *In Progress* light and the *Last Rinse* light simultaneously. Both lights flash *on* for two seconds, then *off* for two seconds, repeating for 10 minutes. After 10 minutes, both lights remain off.

To recover from this error, ensure that the door is securely closed, then start the formula again.

4.1.3. Inverter Fault

When operating normally, the inverter closes an internal contact wired in series with CRDL pins 5 and 8. If the door is closed and the inverter is functioning, the input on MTA3-7 is grounded, as described in Section 4.1.2. If the inverter senses a fault, its internal contacts open and the input on MTA3-7 is lost. This same input is also lost if the door opens during operation. Refer to the inverter documentation for specific troubleshooting procedures.

As happens when the door opens during a formula, the microprocessor signals the error by flashing both the *In Progress* light and the *Last Rinse* light simultaneously. Both lights flash *on* for two seconds, then *off* for two seconds, repeating for 10 minutes. After 10 minutes, both light remain off.

For safety, all machine controls remain disabled for 75 seconds after the error occurs. To open the door after this error, you must first wait the 75 seconds until the controls are enabled.

Then press the *Terminate* button ( ) to clear the error condition. Finally, hold the *Door Unlock* button ( ) and press firmly on the door latch handle.

After correcting any error with the inverter itself, start the formula again.

— End of BICEUT03 —

4.2. Testing TxE Washer-extractors

Document BICEUT02
Spec Date 20010122
As-of Date 20010122

4.2.1. Testing without the Display Kit

Most functions of this machine can be tested with an accurate digital voltmeter if the schematic diagrams are available and you have a thorough understanding of how the machine normally operates.

The following rules will help you determine the current machine event. The events in each formula are listed in "TxE Event Timing" (see table of contents).

1. The *In Progress* light turns *on*, the drain *closes*, the commanded water valves *open*, and the door locks as soon as a formula is selected.
2. The basket begins rotating clockwise four seconds after the *In Progress* light turns *on*. After 20 seconds of clockwise rotation, the basket dwells for four seconds, then rotates counter-clockwise for 20 seconds.
3. When the desired level is achieved, the water valves *close* and the formula timer runs.
4. Signals for the injection of any desired chemicals occur 15 seconds after the timer starts counting for the bath. Chemical injection signals last 30 seconds.
5. The chemical manifold flush signal activates 15 seconds after the chemical injection signal ends, and lasts for 30 seconds.
6. When 15 seconds remain in any bath step, the basket *dwells* for four seconds, then *rotates* clockwise for the remaining 11 seconds of the step. This ensures that the basket is rotating clockwise when drain speed is commanded.
7. The drain *opens* 15 seconds after drain speed is commanded.
8. The motor *runs* at drain speed for 30 seconds after the drain opens.
9. If the drain step is immediately followed by a bath step (without an intervening extract), the basket *coasts* for 15 seconds before the next bath begins. The basket does not coast after a drain step if the next step is an extract.
10. The basket coasts for 75 seconds after an extract step.
11. The *Door Unlock* button is enabled when the coast ends (75 seconds after the final extract ends).

4.2.2. Testing with the Display Kit

A kit consisting primarily of a vacuum fluorescent display and a wiring harness to connect the display to the microprocessor controller is available from the Milnor® factory. Contact the Milnor® parts department for details.

Caution 9: Avoid machine damage—Because of the additional power required to operate the display, certain microprocessor controller components may be damaged if the display is connected for extended periods of time.

- Connect the display only when testing the machine.
- Disconnect the display and replace all control panel covers before returning the machine to normal operation.

4.2.2.1. Connecting the Display

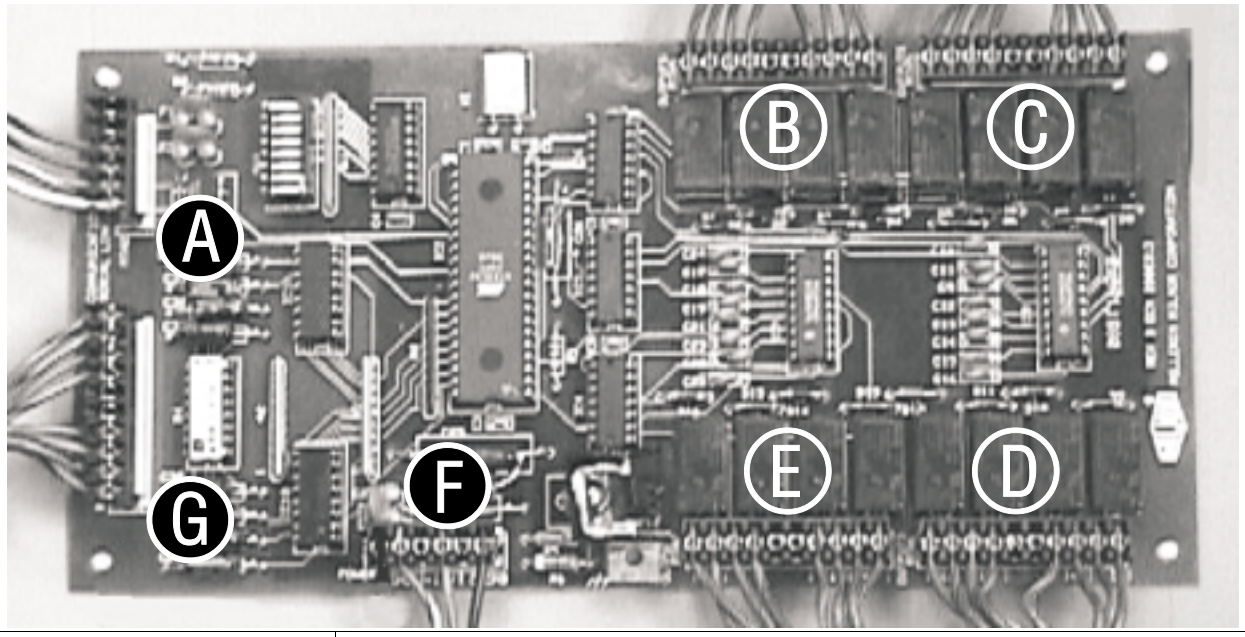
1. Lock off and tag out power to the machine.
2. Remove the cabinet top and rear panels to gain access to the microprocessor controller. When viewed from the rear of the machine, the controller is mounted to your left. Don't try to connect the display to the large white Magnetek component (motor inverter) to your right.
3. Connect the flat black connector on the display cable to MTA2 on the controller. Use Figure 7 as a reference to properly orient the connector to the pins on the controller; the four wires in the connector should be on the side nearest MTA3, and the four connector sockets without wires are nearest the long side of the board.

Caution 10: Avoid personal injury and machine damage—Because the machine must have power available for testing, use extreme caution when working in the area of high voltage and moving mechanical parts.

- Lock off and tag out power before reaching into the machine.
- Route the display wiring clear of the motor and pulleys.

Figure 7: Microprocessor Controller Components

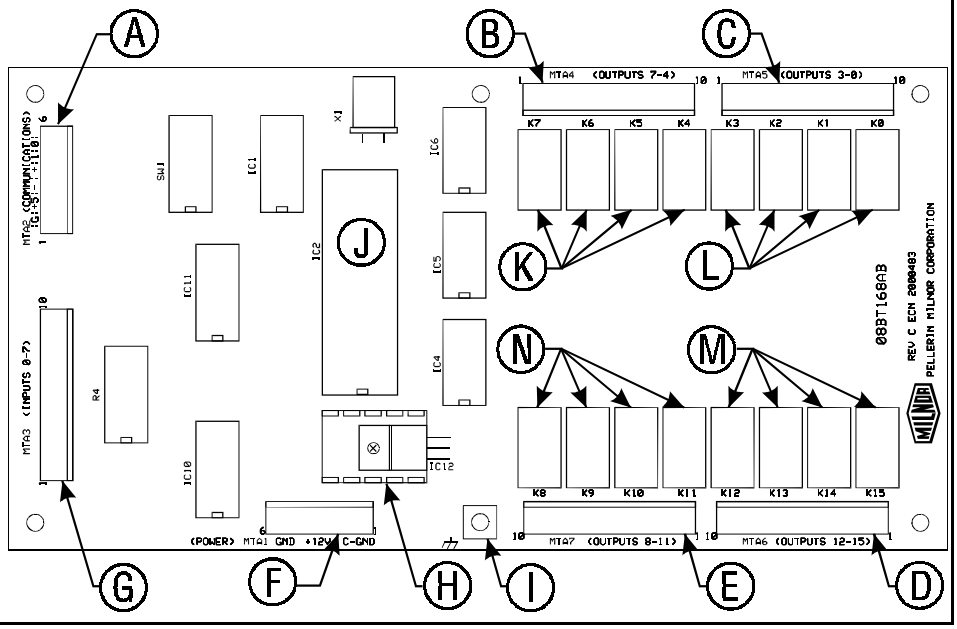
Photograph



Legend

- **A.** MTA2 (display)
- **B.** MTA4 (outputs)
- **C.** MTA5 (outputs)
- **D.** MTA6 (outputs)
- **E.** MTA7 (outputs)
- **F.** MTA1 (power)
- **G.** MTA3 (inputs)
- **H.** Voltage regulator and heat sink
- **I.** Chassis ground
- **J.** Micro-controller chip
- **K.** Outputs K4 through K7
- **L.** Outputs K0 through K3
- **M.** Outputs K12 through K15
- **N.** Outputs K8 through K11

Illustration



4.2.2.2. Displays in Run Mode—With the display connected and power to the machine, you can select from three display modes without changing the DIP switch settings: *timer*, *inputs*, and *outputs*. The *timer display* shows certain general information about the current formula, as explained in Section 4.2.2.2.1. The *inputs display* (Section 4.2.2.2.2) shows the on/off status of each of the eight inputs. The *outputs display*, described in Section 4.2.2.2.3, shows the on/off status of the 16 outputs.

4.2.2.2.1. Timer Display—When power is supplied to the machine, the display shows the time remaining in the power-up safety delay and the *In Progress* light flashes.When a formula is started, the display shows certain information about machine operation as it happens.

Display or Action	Explanation
`Please Wait 74 Secs.`	Typical power-up display immediately after applying power to the machine. The *In Progress* light (1) flashes during the delay.
`F:x EQ:xxx CE:xxx` `Level Ax/Dx T-Stop`	Typical display when the machine is ready to run, but before starting a formula.

F:x—Selected formula. In this field, x may be replaced by A, B, C, or D, depending on which formula is running.

EQ:xxx—Elapsed quarters. This field shows how many quarter-minute (15-second) periods have expired since the timer began running.

> **Note 10:** Because the timer doesn't start running until the desired level is achieved, this field will not change from 000 to 001 until 15 seconds after level is achieved.

CE:xxx—Current event. Each of the four available wash formulas is made up of a series of events. These events are numbered upward continuously through all formulas, so formula A contains events 0 through 9, formula B is events 10 through 23, etc. Tables with descriptions of all events are in "TxE Event Timing" (see the table of contents).

Level Ax/Dx—Level achieved and desired. Low level is represented by "1," and high level is represented by "2." Achieved level is the number after "A," and desired level is the number after "D." For example, A0/D2 indicates that level 2 is desired, but the actual level is still below low level. A2/D2 indicates that level 2 is desired and achieved.

T-xxxx—Timer status. "T-Run" indicates that the timer is running, while "T-Stop" indicates that the timer is stopped. The timer is stopped while the machine is filling and when the *timer stop* input is present.

4.2.2.2.2. Inputs Display—From the timer display with a formula running, press the *Formula C* button once to view the on/off status of the eight controller inputs.

Display or Action	Explanation
`F:C EQ:026 CE:024` `Level A1/D1 T-Run`	This is a typical timer display.

Display or Action	Explanation
C	Scrolls from the timer display to the inputs display.
ABCDEFGH ----+-+-	This is a typical input status display during a bath with a chemical. See Table 7 for the input that corresponds to each character on the display. A plus sign (+) appears below each active input; a minus sign (–) appears below each input that is not present. In the example display to the left, inputs E and G are present, indicating that the door is closed and low level is achieved.

Table7: TxE Inputs

Display Letter	Input Description	Connector and Pin	Notes
A	Formula A button depressed or timer stop commanded	MTA3-1	Timer stops while button is depressed.
B	Formula B button depressed	MTA3-2	
C	Formula C button depressed	MTA3-3	Can't be tested, but can be assumed functional if you can view the inputs display.
D	Formula D button depressed	MTA3-4	
E	Door is closed and inverter functioning	MTA3-7	Input is lost when door opens or inverter faults during a formula.
F	Terminate button is depressed	MTA3-8	Testing terminates current formula.
G	Low level achieved	MTA3-9	
H	High level achieved or vibration safety switch closed	MTA3-10	Water valves close or controller terminates extract step.

4.2.2.2.3. Outputs Display—From the inputs display, press the *Formula C* button once to view the on/off status of the 16 controller outputs.

Display or Action	Explanation
ABCDEFGH ----+-++	This is a typical *input status* display during a flush or rinse bath.
C	Scrolls from the *inputs* display to the *outputs* display.
abcdefghijklmnop --+--+---+------	This is a typical output status display during a bath with a chemical. See Table 8 for the output that corresponds to each character on the display. A plus sign (+) appears below each active output; a minus sign (–) appears below each output that is not energized. In the example display to the left, outputs c, f, and j are present, indicating that the drain is closed, the motor is energized in the clockwise direction, and the *Formula Running* light is lit.

Table8: TxE Outputs

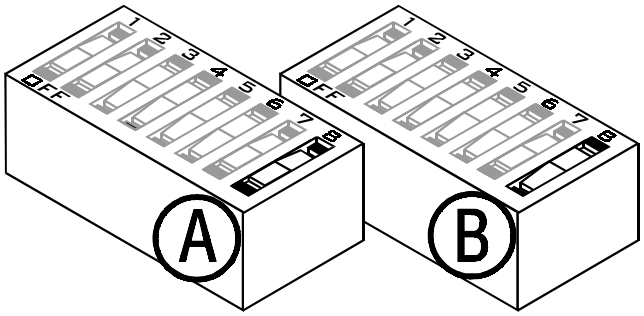
Display Letter	Output Number	Output Description	Connector and Pins	Notes
a	K0	Enable Door Unlock button	MTA5 pins 9 and 10	energized for first 45 seconds of formula
b	K1	Signal inverter for drain speed	MTA5 pins 7 and 8	
c	K2	Close drain	MTA5 pins 3 and 4	
d	K3	Open hot water valve	MTA5 pins 1 and 2	
e	K4	Open cold water valve	MTA4 pins 9 and 10	
f	K5	Signal inverter for clockwise wash	MTA4 pins 7 and 8	
g	K6	Signal inverter for counter-clockwise wash	MTA4 pins 3 and 4	
h	K7	Signal inverter for extract speed	MTA4 pins 1 and 2	
i	K8	Turn on Last Rinse light	MTA7 pins 9 and 10	light illuminates when last bath step begins; flashes to signal error
j	K9	Turn on In Progress light	MTA7 pins 7 and 8	light is on throughout formula; flashes to signal error
k	K10	In Progress slave	MTA7 pins 3 and 4	operates same as K9
l	K11	not used	MTA7 pins 1 and 2	
m	K12	Flush chemical manifold	MTA6 pins 9 and 10	
n	K13	Inject soap	MTA6 pins 7 and 8	
o	K14	Inject bleach	MTA6 pins 3 and 4	
p	K15	Inject sour/softener	MTA6 pins 1 and 2	

4.2.2.3. Displays in Test Mode—Observing the action of inputs and outputs during normal operation is an important part of troubleshooting the machine. However, testing for a specific problem can often be done more efficiently by actuating specific outputs and grounding inputs individually. The test mode provides a display for viewing input and output status, and for actuating outputs.

4.2.2.3.1. Setting the DIP Switch for Test Mode

1. Lock off and tag out power to the machine.
2. Remove the cabinet top and rear panels to access the microprocessor controller. The controller is mounted to your left as you view the machine from the back.
3. Using the instructions in "Configuring TxE Model Washer-extractors" (see table of contents), turn *off* position 8 of DIP switch SW1. See Figure 8.

Figure 8: Selecting Test Mode on DIP Switch SW1

Illustration	Legend
	**A.** Position 8 *On* for *Run* mode (normal setting) **B.** Position 8 *Off Test* mode (troubleshooting only)

4. Apply power to the machine. The display will appear similar to this:

Display or Action	Explanation
`ABCDEFGH  Output #` `--------   00 is On`	Normally, inputs A through H will be *off* (noted by a minus sign [–] below the letter) except perhaps input E. Input E will normally be *on* (noted by a plus sign [+] below the letter) if the machine door is closed. Output 00 is on, indicating that the *Door Unlock* button (🔓) is enabled.

4.2.2.3.2. Interpreting the Display

Display or Action	Explanation
`ABCDEFGH  Output #` `----+---   00 is On`	This is the testing display as it appears at power-up with the door closed. The eight inputs appear on the left of the display, and each output appears on the right side as it is actuated. This display shows that input E is enabled, indicating that the door is closed.

4.2.2.3.3. Viewing Inputs—Two types of tests can be performed while observing the status of the inputs:

- testing the switch or other auxiliary component that provides the input to the controller, and
- testing the controller and how it behaves when certain inputs are present.

Testing Auxiliary Components—The TxE controller has eight inputs into the controller, six of which can be actuated from the control panel on the front of the machine. The two level switch inputs require grounding terminals on the level switch.

Caution 11: Avoid personal injury—When input A is grounded, the machine automatically closes and opens each of the 16 outputs in sequence. This arrangement prevents the motor from turning the cylinder at drain or extract speed, but allows the cylinder to turn at wash speed in either direction if the door is closed.

- Never attempt to defeat the safety mechanisms to test cylinder rotation with the door open.

Formula A and *timer stop* (Input A)—This input is grounded (changes from – to +) when A is pressed, indicating that the keypad button is working and the processor is correctly interpreting the signal. If the *timer stop* feature of this machine is used (usually by the

chemical supply system), grounding this input while the machine is running a formula causes the timer to stop counting until the input is released.

Caution 12: Entanglement hazard—Because the *Formula A* button (A) also tests the machine outputs, the motor may start and the cylinder may turn when this button is pressed.

- Ensure that no one is near the motor or drive pulley during testing.

Formula B (Input B)—This input is grounded when B is pressed, indicating that the keypad button is working and the processor is correctly interpreting the signal.

Formula C (Input C)—This input is grounded when C is pressed, indicating that the keypad button is working and the processor is correctly interpreting the signal.

Formula D (Input D)—This input is grounded when D is pressed, indicating that the keypad button is working and the processor is correctly interpreting the signal.

Door Closed and inverter functioning (Input E)—This input is grounded when the processor sees the that door is securely closed and the inverter is functioning properly. The machine will not run if this input is not grounded (+).

Terminate button (Input F)—This input is grounded when the *Terminate* button ( ) is pressed.

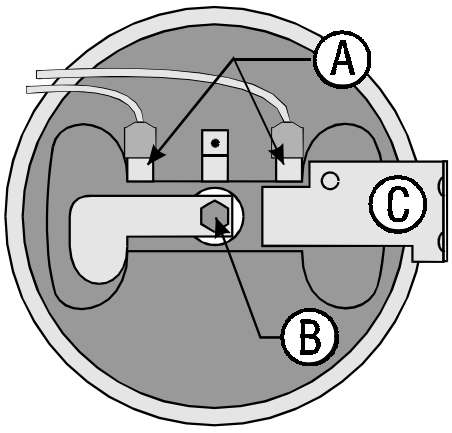
Low level achieved (Input G)—This input is grounded when the level switch for low level (SPLL on the schematic) is closed. This can be simulated by briefly touching a length of wire between the power and ground terminals (see Figure 9) on the level switch. Do not remove the wires from these terminals for this test.

High level achieved or vibration safety switch tripped (Input H)—This input is grounded when the level switch for high level (SPHL on the schematic) is closed. This can be simulated by briefly touching a length of wire between the power and ground terminals (see Figure 9) on the level switch. Do not remove the wires from these terminals for this test. This input is also made when the vibration safety switch trips. The vibration safety switch can be tested by gently holding the pendulum to one side and watching for the input status to change.

Note 11: High level pressure switch SPHL has two wires attached to one of the terminals and one wire attached to the other terminal. Low level pressure switch SPLL has only one wire attached to each terminal.

Figure 9: Level Switch Testing

Typical Level Switch



Legend

A. Power and ground terminals
B. Level adjusting screw
C. Mounting bracket

Testing the Controller —The input testing procedures described in Section 4.2.2.3.3.1 verify that the the microprocessor controller is receiving a signal from an external component, processing the signal, and writing the results to the display. Further testing is required if a component is actuated as described above, but the display does not indicate that it's actuated. By using the information in Section 4.2.2.3.3.2 and the schematic manual, a fully qualified technician can determine whether the problem lies with the component or the microprocessor controller.

4.2.2.3.4. Testing Outputs—The TxE controller operates the chemical system and all other devices in the machine by turning output relays on and off according to specific instructions. For example, output relay K2 is dedicated to the machine drain. When this relay is energized, it closes a circuit between pins 3 and 4 on MTA5 to provide power to the drain valve. Because a spring in the drain valve opens the drain valve when power is not present, the drain is closed only while output K2 is closed.

While all output relays can only be open or closed, two types of results can be achieved from any output, depending on how it is used in the machine:

Direct outputs—These outputs, such as the *drain output* relay (K2) and the *last rinse output* relay (K8), act as a switch in the circuit for the device to which they are assigned. Output K2 is described above. Output K8 closes when the last bath step of a formula begins, providing power to the *Last Rinse* light on the control panel.

Indirect (signal) outputs—Indirect outputs signal another device to operate. The most important of these are the outputs that control how the motor inverter powers the motor to turn the basket. When output K5 is closed, the inverter powers the motor to turn clockwise at wash speed. Output K6 causes the inverter to run the motor counterclockwise, but still at wash speed. When outputs K5 and K7 are on (contacts closed) at the same time, the basket runs clockwise at extract speed. The chemical outputs (K13, K14, and K15) signal the chemical supply system to provide chemical to the machine. Output K12 signals to flush the chemical injection manifold.

Caution 13: Avoid machine damage—This controller is designed to allow the **momentary** actuation of outputs to verify proper operation. Continuous manual operation of outputs may cause machine damage, especially if chemicals are actuated and not flushed completely from the machine after testing.

- If chemicals are connected to the machine when outputs are tested, always activate the flush output to dilute and flush out any chemical in the manifold and the machine.

Display or Action	Explanation
A	Press and release this button to turn off the current output and select and actuate the next one. For example, if the display says, "Output #3 is On," press A one time and release it to turn off output 3 and turn on output 4. The display then shows, "Output #4 is On."
	Hold this button depressed to automatically cycle through all 16 outputs. As described above, only one output is actuated at any time. The display will turn each output on for approximately one half second, then advance to the next output in numerical order.

The goal in testing outputs is to verify that the specified device operates when the controller commands it to operate. Some devices, such as water valves and chemical injections, cause a result that can be seen or heard (water or chemical entering the machine). Others, especially drain and extract speed commands, can only be verified with the proper use of a voltmeter. Use the information below and the electrical diagrams for this machine to test a component.

Door Unlock button (Output 00)—When this output is *on*, the *Door Unlock* button (🔓) on the control panel is energized. Press the *Door Unlock* button and listen for an audible click as the door latch is unlocked. If the door latch does not unlock, check for control voltage between fuse EF71B and pin 10 of MTA5 when the relay should be closed, dropping to 0 volts when the relay should be open.

Drain Speed inverter signal (Output 01)—This output signals the inverter to run the motor at drain speed. However, both the clockwise wash signal and the drain speed signal must be present for the basket to turn. Test this output relay (K01) by checking for a signal of 24 volts DC between pins 7 and 8 of MTA5 when the relay should be off, dropping to 0 volts when the relay should be on.

Drain Closed (Output 02)—This output relay closes to energize the normally-open drain valve, causing it to close. Test relay K02 by observing the drain valve under the machine or by checking for control voltage between fuse EF71B and pin 3 of MTA5 when the relay should be closed (drain closed), dropping to 0 volts when the relay should be open (drain open).

Hot Water Valve On (Output 03)—This output relay closes to energize the normally-closed hot water valve, causing it to open. A voltmeter should indicate control circuit voltage between fuse EF71B and pin 1 of MTA5 when the valve is open and hot water is flowing into the machine, dropping to 0 when the valve is closed.

Cold Water Valve On (Output 04)—This output relay closes to energize the normally-closed cold water valve, causing it to open. A voltmeter should indicate control circuit voltage between fuse EF71B and pin 9 of MTA4 when the valve is open and cold water is flowing into the machine, dropping to 0 when the valve is closed.

Caution 14: Entanglement hazard—The machine basket rotates when output 05 or 06 is actuated.

- Keep all personnel clear of the motor and drive components when testing these outputs.

Clockwise Wash Speed inverter signal (Output 05)—This output signals the inverter to run the motor clockwise at wash speed. Test this output relay (K05) by checking for a signal of 24 volts DC between pins 7 and 8 of MTA4 when the relay should be *off*, dropping to 0 volts when the relay should be *on*.

Counter-clockwise Wash Speed inverter signal (Output 06)—This output signals the inverter to run the motor counter-clockwise at wash speed. Test this output relay (K06) by checking for a signal of 24 volts DC between pins 3 and 4 of MTA4 when the relay should be *off*, dropping to 0 volts when the relay should be *on*.

Extract Speed inverter signal (Output 07)—This output signals the inverter to run the motor at extract speed. However, both the clockwise wash signal and the extract speed signal must be present for the basket to turn. Test this output relay (K07) by checking for a signal of 24 volts DC between pins 1 and 2 of MTA4 when the relay should be *off*, dropping to 0 volts when the relay should be *on*.

Last Rinse Light On (Output 08)—Output K08 closes to power the *Last Rinse* light on the control panel. When the output is *on*, a voltmeter will read the control circuit voltage between fuse EF71B and pin 10 of MTA7. When the output is turned *off*, the voltage drops to 0.

In Progress Light On (Output 09)—When output relay K09 is *on*, the *In Progress* light should be *on* and a voltmeter should read control circuit voltage between fuse EF71B and pin 8 of MTA7.

In Progress Light slave (Output 10)—This relay operates identically to output 09, but is usually used to verify that the machine is running a formula before allowing the chemical supply system to stop the machine timer.

Output relay not used (Output 11)—Output relays K10 and K11 are not used.

Flush Chemical Manifold (Output 12)—When this output is *on*, control voltage flows between fuse EF71B and pin 1 of MTA7. This signal tells the chemical supply system that the chemical injection is complete and the machine desires to flush the chemical injection manifold.

Inject Detergent (Output 13)—When this output is *on*, control voltage flows between fuse EF71B and pin 7 of MTA6. This signal tells the chemical supply system that the machine desires detergent.

Inject Bleach (Output 14)—When this output is *on*, control voltage flows between fuse EF71B and pin 3 of MTA6. This signal tells the chemical supply system that the machine desires bleach.

Inject Sour/softener (Output 15)—When this output is *on*, control voltage flows between fuse EF71B and pin 1 of MTA6. This signal tells the chemical supply system that the machine desires sour/softener or sour/starch.

— End of BICEUT02 —

4.3. TxE Event Timing

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The following tables list the events in each formula. This information is especially useful when testing the machine with the display kit connected, as explained in "Testing TxE Washer-extractors" (see the table of contents).

4.3.1. Hotel and Hospitality Software

4.3.1.1. Formula Set 1

Table9: Events for Hotel and Hospitality Set 1, Formula A

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
0	Suds	Split water to low level	0	32
1	Drain		32	37
2	Rinse	Split water to high level	37	45
3	Drain		45	50
4	Rinse	Cold water to high level	50	58
5	Drain		58	63
6	Sour/softener	Cold water to low level	63	79
7	Drain		79	84
8	Extract		84	112
9	Coast		112	117

Table10: Events for Hotel and Hospitality Set 1, Formula B

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
10	Suds	Hot water to low level	0	40
11	Drain		40	45
12	Rinse	Hot water to high level	45	53
13	Drain		53	58
14	Extract		58	62
15	Coast		62	67
16	Rinse	Split water to high level	67	75
17	Drain		75	80
18	Extract		80	84
19	Coast		84	89
20	Sour/softener	Cold water to low level	89	105
21	Drain		105	110
22	Extract		110	134
23	Coast		134	139

Table11: Events for Hotel and Hospitality Set 1, Formula C

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
24	Suds	Hot water to low level	0	28
25	Drain		28	33
26	Bleach	Hot water to low level	33	61
27	Drain		61	66
28	Rinse	Hot water to high level	66	74
29	Drain		74	79
30	Extract		79	83
31	Coast		83	88
32	Rinse	Split water to high level	88	96
33	Drain		96	101
34	Extract		101	105
35	Coast		105	110
36	Sour/softener	Cold water to low level	110	126
37	Drain		126	131
38	Extract		131	159
39	Coast		159	164

Table12: Events for Hotel and Hospitality Set 1, Formula D

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
40	Flush	Split water to high level	0	8
41	Drain		8	13
42	Suds/bleach	Hot water to low level	13	53
43	Drain		53	58
44	Bleach	Hot water to low level	58	86
45	Drain		86	91
46	Rinse	Hot water to high level	91	99
47	Drain		99	104
48	Extract		104	108
49	Coast		108	113
50	Rinse	Split water to high level	113	121
51	Drain		121	126
52	Extract		126	130
53	Coast		130	135
54	Sour/softener	Cold water to low level	135	151
55	Drain		151	156
56	Extract		156	184
57	Coast		184	189

4.3.1.2. Formula Set 2

Table13: Events for Hotel and Hospitality Set 2, Formula A

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
31	Suds	Hot water to low level	0	40
32	Drain		40	45
33	Rinse	Hot water to high level	45	53
34	Drain		53	58
35	Rinse	Split water to high level	58	66
36	Drain		66	71
37	Rinse	Split water to high level	71	79
38	Drain		79	84
39	Sour/softener	Cold water to low level	84	100
40	Drain		100	105
41	Extract		105	115
42	Coast		115	120

Table14: Events for Hotel and Hospitality Set 2, Formula B

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
19	Suds	Hot water to low level	0	40
20	Drain		40	45
21	Bleach	Hot water to low level	45	73
22	Drain		73	78
23	Rinse	Split water to high level	78	86
24	Drain		86	91
25	Rinse	Split water to high level	91	99
26	Drain		99	104
27	Sour/softener	Cold water to low level	104	120
28	Drain		120	125
29	Extract		125	135
30	Coast		135	140

Table15: Events for Hotel and Hospitality Set 2, Formula C

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
43	Suds and bleach	Hot water to low level	0	80
44	Drain		80	85
45	Rinse	Hot water to high level	85	93
46	Drain		93	98
47	Rinse	Hot water to high level	98	106
48	Drain		106	111
49	Rinse	Split water to high level	111	119
50	Drain		119	124
51	Extract		124	129
52	Coast		129	134
53	Rinse	Split water to high level	134	142
54	Drain		142	147
55	Extract		147	175
56	Coast		175	180

Table16: Events for Hotel and Hospitality Set 2, Formula D

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
0	Suds	Hot water to low level	0	20
1	Carryover	Hot water to high level	20	24
2	Drain		24	29
3	Suds	Hot water to low level	29	61
4	Drain		61	66
5	Rinse	Hot water to high level	66	74
6	Drain		74	79
7	Bleach	Hot water to low level	79	107
8	Drain		107	112
9	Rinse	Split water to high level	112	120
10	Drain		120	125
11	Extract		125	129
12	Coast		129	134
13	Rinse	Split water to high level	134	142
14	Drain		142	147
15	Sour/softener	Cold water to low level	147	163
16	Drain		163	168
17	Extract		168	196
18	Coast		196	201

4.3.2. Healthcare Software

4.3.2.1. Formula Set 1

Table17: Events for Healthcare Set 1, Formula A

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
0	Suds	Split water to low level	0	32
1	Drain		32	37
2	Rinse	Split water to high level	37	45
3	Drain		45	50
4	Rinse	Cold water to high level	50	58
5	Drain		58	63
6	Sour/softener	Cold water to low level	63	79
7	Drain		79	84
8	Extract		84	112
9	Coast		112	117

Table18: Events for Healthcare Set 1, Formula B

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
10	Flush	Split water to high level	0	8
11	Drain		8	13
12	Flush	Split water to high level	13	21
13	Drain		21	26
14	Suds	Hot water to low level	26	54
15	Drain		54	59
16	Bleach	Hot water to low level	59	87
17	Drain		87	92
18	Rinse	Split water to high level	92	100
19	Drain		100	105
20	Rinse	Split water to high level	105	113
21	Drain		113	118
22	Sour/softener	Cold water to low level	118	134
23	Drain		134	139
24	Extract		139	163
25	Coast		163	168

Table19: Events for Healthcare Set 1, Formula C

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
26	Flush	Split water to high level	0	8
27	Drain		8	13
28	Flush	Split water to high level	13	21
29	Drain		21	26
30	Suds	Hot water to low level	26	54
31	Carryover	Hot water to high level	54	58
32	Drain		58	63
33	Bleach	Hot water to low level	63	91
34	Drain		91	96
35	Rinse	Split water to high level	96	104
36	Drain		104	109
37	Rinse	Split water to high level	109	117
38	Drain		117	122
39	Sour/softener	Cold water to low level	122	138
40	Drain		138	143
41	Extract		143	171
42	Coast		171	176

Table20: Events for Healthcare Set 1, Formula D

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
43	Flush	Split water to high level	0	12
44	Drain		12	17
45	Flush	Split water to high level	17	25
46	Drain		25	30
47	Flush	Split water to high level	30	38
48	Drain		38	43
49	Suds	Hot water to low level	43	71
50	Drain		71	76
51	Rinse	Hot water to high level	76	84
52	Drain		84	89
53	Bleach	Hot water to low level	89	117
54	Drain		117	122
55	Rinse	Split water to high level	122	130
56	Drain		130	135
57	Rinse	Split water to high level	135	143
58	Drain		143	148
59	Sour/softener	Cold water to low level	148	164
60	Drain		164	169
61	Extract		169	197
62	Coast		197	202

4.3.2.2. Formula Set 2

Table21: Events for Healthcare Set 2, Formula A

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
0	Flush	Split water to high level	0	8
1	Drain		8	13
2	Suds	Hot water to low level	13	41
3	Drain		41	46
4	Rinse	Hot water to high level	46	54
5	Drain		54	59
6	Rinse	Split water to high level	59	67
7	Drain		67	72
8	Rinse	Split water to high level	72	80
9	Drain		80	85
10	Sour/softener	Cold water to low level	85	101
11	Drain		101	106
12	Extract		106	130
13	Coast		130	135

Table22: Events for Healthcare Set 2, Formula B

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
14	Suds	Hot water to low level	0	40
15	Drain		40	45
16	Bleach	Hot water to low level	45	73
17	Drain		73	78
18	Rinse	Split water to high level	78	86
19	Drain		86	91
20	Rinse	Split water to high level	91	99
21	Drain		99	104
22	Sour/softener	Cold water to low level	104	120
23	Drain		120	125
24	Extract		125	135
25	Coast		135	140

Table23: Events for Healthcare Set 2, Formula C

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
26	Suds and bleach	Hot water to low level	0	80
27	Drain		80	85
28	Rinse	Hot water to high level	85	93
29	Drain		93	98
30	Rinse	Hot water to high level	98	106
31	Drain		106	111
32	Rinse	Split water to high level	111	119
33	Drain		119	124
34	Extract		124	128
35	Coast		128	133
36	Rinse	Cold water to high level	133	141
37	Drain		141	146
38	Extract		146	174
39	Coast		174	179

Table24: Events for Healthcare Set 2, Formula D

Current Event	Event Type	Attributes	Start Time (QQQ)	End Time (QQQ)
40	Flush	Split water to high level	0	8
41	Drain		8	13
42	Suds	Hot water to low level	13	53
43	Drain		53	58
44	Bleach	Hot water to low level	58	86
45	Drain		86	91
46	Rinse	Hot water to high level	91	99
47	Drain		99	104
48	Extract		104	108
49	Coast		108	113
50	Rinse	Split water to high level	113	121
51	Drain		121	126
52	Extract		126	130
53	Coast		130	135
54	Sour/softener	Cold water to low level	135	151
55	Drain		151	156
56	Extract		156	184
57	Coast		184	189

— End of BICEUF02 —